SCIENCE

A WEEKLY JOURNAL DEVOTED TO THE ADVANCEMENT OF SCIENCE, PUBLISHING THE OFFICIAL NOTICES AND PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

FRIDAY, MAY 24, 1901.

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*PROFESSOR ROWLAND, 1848–1901.**

A GREAT man has fallen in the ranks—great in talents, great in achievements, great in renown. Not now need we recall the incidents of his life, nor estimate the characteristics of his impressive personality, nor enumerate his contributions to physical science. We are assembled in this academic hall as his friends, his pupils, his colleagues, about to follow his deserted body to the church, and there in silence to give thanks for such an example, or to utter, with his kindred, words of faith and hope, consecrated by the comfort they have given to the mourners of many climes and of many centuries. Before these last rites, we pause to think what sort of a man was this whom we so love and honor, whom we so lament, whose death, in one aspect, seems so premature; in another, crowned with the best that earth can give.

* An address before the officers and students of the Johns Hopkins University, assembled before the funeral, April 18, 1901.

Our friend was born with a powerful mind, and the older he grew the more powerful it appeared to those who knew him intimately and to those most capable of understanding the problems and the methods which engaged his thoughts. Others may have eyes as keen and fingers as facile, but his vision and his dexterity were controlled by a brain of extraordinary fineness, versatility and strength. Nobody could walk with him, hunt with him, sail with him, talk with him, work with him, without perceiving his firm grasp, his clear aim, his concentrated energy, his extraordinary powers. In early youth his mind was directed to the study of nature—not so much to plants and animals as to physical and chemical forces. This was the bent of his life. It is true that he was fond of music, classical music especially—Chopin's funeral march, for example—and he loved good works of art—the Madonnas of Raphael, for example.

Yet he cared but little for literature, having showed, in his early days, a boyish animosity toward Greek and Latin which he never wholly overcame. Aristotle was no authority to him. But the mysterious forces of the physical world—gravitation, sound, light, heat, electricity and magnetism—were his constant study. The principles of mechanics were to him of fundamental importance, and mathematics was subservient to all his investigations. In this broad field he was a reader, a student, an experimenter, an inventor, a discoverer, a philosopher. He knew how to ask a difficult and far-reaching question, and he knew how to seek the answer.

Extraneous considerations were excluded when he saw the point of an inquiry, and on that point he concentrated all his powers. For example, when he began the brilliant series of experiments in spectrography which made him peerless in this domain, he saw that the spectrum depended on the accuracy of the gratings, and the gratings on the dividing engine, and the dividing engine on the screw—so he began the study of light by devising and making a screw more exact than any screw that has ever been produced by the most accomplished makers of instruments of precision, and then he saw that photography must be improved before he could reveal to the eye of others the intricacy of the solar spectrum.

His intellectual apparatus was controlled by a powerful will. When he was determined upon a given course, no regard for consequences, no apprehension of perils or of difficulties, no dread of failure, proved a barrier. They heightened his zest. Fortunately his ends were noble and his proceedings wise, so that rarely, if ever, did failure disappoint him or weaken his self-confidence. He would have been a great soldier, a great explorer, a great lawyer.

But above his keen perceptions, his logic, his adaptation of means to ends, and his marvelous concentration, I must place another moral quality—one that appeals to every one of us, whether we understand his determination of the mechanical equivalent of heat, or the steps by which he arrived at the value of the ohm. This moral quality is the love of truth. Of course, he was true in all the ordinary relations of life. That is the beginning of truth, but not the end of it. He was also true in all his investigations, careful to eliminate errors, to avoid preconceptions, to shrink from hasty conclusions and inferences, to be critical of other investigations, to be accurate, exact, conscientious, to spare no pains, to shrink from no efforts, to conceal no difficulties, in order that the absolute facts might be established, so far as this can be done by limited humanity. To him science was another word for truth—not all the truth, but that amount of truth which the limited powers of man have discovered. He was a follower of Isaac New-

ton, picking up upon the seashore a few pebbles and discerning their lessons.

At the close of our first decennium, two speakers were brought forward to tell, respectively, what had been the aims of this University in providing for the study of science and letters. These speakers were Professor Gildersleeve and Professor Rowland. They had no preliminary conference, but each brought his discourse to a close by a return to the key-note—the key-note which had governed and should govern our personal behavior and the harmonies of our associated lives as members of the Johns Hopkins University.

Said the exponent of letters: "First and last, the scientific standard must be upheld for the university man, be he a student of letters, be he a physicist; and that standard is the absolute truth, the ultimate truth. 'Nothing imperfect is the measure of anything,' says the prince of idealists."

Said the man of science: "But for myself, I value in a scientific mind most of all that love of truth, that care in its pursuit, and that humility of mind which makes the possibility of error always present more than any other quality. This is the mind which has built up modern science to its present perfection, which has laid one stone upon the other with such care that it today offers to the world the most complete monument to human reason. This is the mind which is destined to govern the world in the future and to solve problems pertaining to politics and humanity as well as to inanimate nature.

"It is the only mind which appreciates the imperfections of the human reason and is thus careful to guard against them. It is the only mind that values the truth as it should be valued and ignores all personal feeling in its pursuit. And this is the mind the physical laboratory is built to cultivate."

These are words worthy to be recalled by the successive groups of students who come here for instruction and counsel as the years roll on. Let us sacredly cherish our inheritance.

In closing, let me call our departed brother, our dear colleague, our honored teacher, our ornament, our pride and our delight, by another nobler title. He was a servant of the Lord. If one who leads a life of purity, fidelity and integrity, and who consecrates, without self-seeking, his strength, his talents, his time, at home and at his laboratory, in health and in bodily infirmities, in youth and in maturity, to the interpretation of the laws by which the cosmos is governed, is a servant of the Lord, —then reverently and truly we may say of our departed friend he was a servant of the Lord, Maker of heaven and earth. Let me apply to him words of the Master, whom he was taught from childhood to revere. His 'eye was single' and 'his whole body was full of light.'

DANIEL C. GILMAN.
JOHNS HOPKINS UNIVERSITY.

AN OUTLINE OF THE PROGRESS OF CHEMISTRY IN THE NINETEENTH CENTURY.*

CHEMISTRY is one of the youngest of the natural sciences. Its growth and development have taken place almost entirely in the past one hundred years. Nevertheless, it is well to remember that some of the foundation stones of the science were laid in the latter part of the eighteenth century. There was no such thing as a science of chemistry in the time of the ancient Greeks and Romans. Nor during the middle ages, nor previous to the year 1750 can there be said to have been any systematized chemical knowledge.

In the middle of the eighteenth century the attempt was made to explain in a general way that most striking of all ordinary

* Address delivered before the Academy of Science at St. Louis, on March 18th.

chemical changes, namely, fire or combustion. It was noticed that there are two classes of bodies, those that will burn and those that will not. The former were assumed to contain the element of fire or phlogiston. In the process of burning the phlogiston was supposed to escape into the air; the ashes or products of combustion remained behind. The act of burning was looked upon as a decomposition. Combustible bodies were all supposed to be of a compound nature, consisting of phlogiston and the products of combustion. In the act of burning these two elements separated, the phlogiston going off into the air, the products of combustion remaining behind as the ashes.

This first theory of chemistry was replaced by a better one in the year 1785 by Lavoisier, the distinguished French chemist. Last summer a bronze statue of Lavoisier was unveiled in Paris. It bears a single inscription, namely, 'The founder of Modern Chemistry.' Lavoisier found that when bodies burned the products of combustion were heavier than the original substances. A few years previous to this, in 1774, Joseph Priestley, the English clergyman, had found that when the red calx of mercury is heated oxygen gas is obtained, and that substances burn very brilliantly in this gas. Lavoisier repeated the experiments of Priestley, saw, what the latter failed to see, that burning was the union of oxygen with the burning substance and that combustion was a chemical combination and not a decomposition. 'There is no such thing as phlogiston, the element of fire,' said Lavoisier; and from this time on all substances that could not be resolved into simpler substances weighing less than the original substances were called elements.

Thus began a new era for chemistry, a quantitative era, in the year 1785. From now on the balance became the chief instrument of chemical investigation. Such in brief was the condition of chemistry one hundred years ago. The ideas of Lavoisier had, at the opening of the last century, come to be very generally accepted, but very little was known beyond these. Oxygen was the chief element and the oxides the chief compounds or, as Berzelius said: 'Oxygen was the center point about which chemistry revolved.' The knowledge of the composition of other substances was very imperfect. It was not even known at that time that substances do have a fixed composition; indeed the fundamental laws of chemical action were still all undiscovered. Almost nothing was known of the composition of substances of vegetable or animal origin, that great and important class of bodies that we now know as organic substances. A century ago it was not known that alcohol contained oxygen; this fact was found out in the year 1809. There were no laws and principles, no generalizations; chemistry consisted of purely descriptive matter, and that was often very imperfect. In organic chemistry was largely mineralogy, organic chemistry was chiefly botany.

Limited as chemical knowledge was when the nineteenth century opened, there were, however, certain men at work, who had adopted the quantitative methods of Lavoisier, and who soon made important discoveries. First of all Proust, in 1801, announced that every chemical compound has a fixed and definite composition, that when substances unite chemically they do so in definite ratios by weight. This statement of Proust's was not allowed to go unchallenged. C. L. Berthollet maintained that compounds have a variable composition, and that if there are any that do appear to have a fixed composition it is an exception and not the rule. For eight years the controversy was carried on between these men. Proust finally came out victorious. More and more analyses of compounds were made,

until it was clearly established that every distinct substance has a fixed and unalterable composition. The second great law of combination was discovered in 1804 by John Dalton, and it is commonly called the law of multiple proportions. To explain these laws of combination, Dalton introduced the atomic theory into chemistry, and from now on the great problem was to determine the relative weights of the atoms. When the history of chemistry in the nineteenth century comes to be written, it will be largely the history of the atomic theory, and for more than sixty years the two great problems to which the most eminent men gave their attention were the determination of the atomic weights and of the arrangement of the atoms in compounds. It would be a long story to trace out step by step how these problems were solved. The men who did most in this direction were Berzelius, Dumas, Liebig, Gerhardt and Laurent, Cannizzaro and Kekulé. As a result of their work, it began to be generally recognized, about 1865, that these two problems had been satisfactorily solved, and from that time on there has been no question as to the reasoning employed in fixing upon a number to represent the atomic weight of an element, or to determine the way in which the atoms are linked together in a compound.

Side by side with this development of chemical theory has gone the discovery of new elements and compounds. Instead of the thirty elements or simple substances known at the beginning of the last century, we now have seventy-eight. Instead of a few scores of distinct compounds of definite composition, we now have thousands of these substances. To-day there are known 75,000 compounds of carbon alone. In the years 1859 and 1860 Bunsen and Kirchoff devised the spectroscope, and it has become, next to the balance, the most important instrument of chemical investigation. By means of it the elements rubidium, cesium, thallium, indium, gallium, scandium and helium have been discovered.

THE PERIODIC LAW.

Soon after the atomic weights had been determined satisfactorily, a very remarkable relationship was discovered by Lothar Meyer and Mendelejeff to exist between the atomic weights and the properties of the elements. It was found that when the elements were arranged in the order of increasing atomic weights, beginning with the lowest and going up regularly to the highest, there was a periodic variation in the properties of the elements. For example, it was noticed that the 8th element resembled the first, the 9th was analogous to the 2d, and so on. Mendelejeff expressed this fact in the following way: "The properties of the elements," he said, "are a periodic function of their atomic weights." By means of this law Mendelejeff was able to foretell the existence of new elements and to predict their chemical and physical properties. When the table of elements was first arranged it was incomplete, there were blank spaces. Mendelejeff predicted that elements would be found that would fill these spaces, and from the properties of the adjoining elements he foretold the properties of the unknown elements. In this way he predicted the properties of an element that would resemble boron, another that would be analogous to aluminum, and a third that would be closely related to silicon. These predictions have all been fulfilled. In 1879 Nilson discovered scandium and found that it had all of the properties of the unknown element that resembled boron, in 1875 Boisbaudran discovered gallium; it was the element resembling aluminum, and in 1885 Winkler discovered germanium; its properties were almost identical with those that had been predicted for the element resembling silicon.

NEW ELEMENTS FOUND IN AIR.

In the last few years it has been found that ordinary air contains some elements, the existence of which had not even been suspected. For nearly three-quarters of a century it was supposed that we knew all about the composition of the air, but in 1892 Lord Rayleigh found that a globe filled with atmospheric nitrogen weighed more than the same globe filled with nitrogen made from chemical compounds containing nitrogen, and this observation followed up led to the discovery of argon, an inert gas, present to the extent of about one per cent. in the air. Then efforts were made to find argon in mineral substances; certain minerals that were supposed to give off nitrogen on heating were heated in vacuous vessels and thus helium was discovered. Recently Professor Ramsey has found two other inert gases in air besides argon; he obtains them by the fractional evaporation of liquid air, and he has named them neon and kripton. Quite recently it has been claimed that the mineral pitch blende contains the elements radium, polonium and actinium, and that these elements emit rays that are capable of producing skiagraphic images on sensitive plates, and of discharging electrified bodies.

PROGRESS IN INDUSTRIAL CHEMISTRY.

Hand in hand with the development of scientific chemistry and the discovery of new compounds has gone the improvement of manufacturing processes and the methods of industrial chemistry. At the beginning of the last century potash was the chief alkali, and this was obtained from wood ashes. Leblanc invented a method of obtaining soda from salt, and for many years this was the only way of getting alkali on the large scale. Now this method has been almost entirely replaced by the Solvay or ammonia-soda process, and it is very probable that before many years this in turn will be replaced by the electrolytic process of obtaining alkali from salt solutions. There is a constant evolution of new methods in chemical industry, the older processes have to give way to more economic and perfect methods. For more than one hundred years, all the sulphuric acid that is used has been made in lead chambers, and one improvement after the other was added to this process until it was brought to a high state of perfection; but now, with the opening of the new century, the sulphuric acid manufacturers are pulling down their lead chambers. A new and better method of making the acid has been devised. Sulphur dioxide and air are led over finely divided platinum and the resulting sulphur trioxide is conducted into water. It has long been known that sulphuric acid can be made in this way on the small scale in the laboratory, but it is only recently that the principle has been adapted to the commercial preparation of the acid. Heretofore the difficulty has been that the contact substance, the finely divided platinum, soon lost its activity. Now it has been found that this can be overcome by carefully purifying the gases before they come in contact with the platinum, and that, by keeping the temperature of the interacting gases below the point of decomposition of the sulphur trioxide, the action can be carried on indefinitely and on the commercial scale. The resulting sulphur trioxide is led into water and sulphuric acid of any degree of concentration obtained.

Other important changes in industrial chemistry have been brought about by the application of electricity to the preparation of chemical elements and compounds. Places like Niagara Falls that have abundant water power for the production of electric currents are rapidly becoming the seats of important chemical industries. The electric current is at present used chiefly in two ways in inorganic chemistry. First

it is used for the production of very high temperatures in the electric furnace. In simple form the electric furnace consists of a box made of fire bricks in which the carbon poles of an electric arc light are placed. Under the influence of the high temperatures produced between the carbon pencils nearly all metal oxides are reduced by carbon. Aluminium oxide is reduced in this way at Niagara Falls, and aluminium bronze, an alloy of aluminium and copper, is made. Sand is reduced in the same way, and the element silicon unites with the excess of carbon and forms the compound carborundum, an exceedingly hard substance which is used so extensively as a substitute for emery. Artificial graphite and phosphorus are also made in the electric furnace and the carbides of a large number of metals have been prepared. Of these carbides calcium carbide has become of commercial importance, as it is used extensively for making acetylene.

The other way in which the electric current is utilized is for the electrolysis of liquids, either solutions of substances in water or fused substances. At Niagara metallic sodium is now made by the electrolysis of fused caustic soda. One of the uses of the metallic sodium is to prepare sodium peroxide, the new bleaching agent, for which purpose the metal is burnt in dry air. Metallic aluminium is obtained by the electrolysis of aluminium oxide in a fused bath of cryolite. Caustic soda and chlorine are made by the electrolysis of salt solutions, and potassium chlorate by the electrolysis of potassium chloride solution. The electric current is also used in refining certain metals, for which purpose sheets of the crude metal are suspended at one pole in a bath of the metal salt and the pure metal deposited at the other pole.

During the past century great progress has been made in the methods of extracting the metals from their ores. Not only has this been true of iron, but of all the useful metals. As an example, it is only necessary to call attention to the cyanide process of extracting gold and silver. Gold and silver ores which are so poor that it was unprofitable to work them in previous years are now successfully treated with a solution of potassium cyanide, which has the power, in the presence of air, of dissolving the noble metals. It is this method which has largely contributed to the increased production of gold in recent years. Side by side with this improvement of metallurgical processes has gone the utilization of by-products. Not only is blast-furnace slag used in making Portland cement, but other slags, such as those obtained in the basic steel process and which contain phosphoric acid, are used as fertilizers. The sulphur dioxide formed by roasting lead and zinc ores is no longer allowed to escape into the air, but is converted into sulphuric acid.

PROGRESS IN ORGANIC CHEMISTRY.

But undoubtedly the most rapid strides in the development of chemistry have been made in the past century in that department known as organic chemistry. One hundred years ago our knowledge of the compounds occurring in the organs of plants and animals was very meager indeed. A few organic substances had been isolated, but their composition was very imperfectly known, as the methods of analysis were very crude. Liebig in 1830 improved the method of analyzing these compounds and thus laid the foundation of organic chemistry.

A century ago it was generally believed that organic compounds could not possibly be made artificially by synthesis in the laboratory, as was the case with mineral compounds. It was thought that a peculiar vital force in some way intervened in their production in the organs of plants and

animals, and that we could never expect to prepare them in the laboratory. But this idea soon had to be abandoned, for in 1828 Wöhler succeeded in building up urea from simple inorganic substances, and thus the first synthesis of an organic substance was effected. This was soon followed by that of acetic acid by Kolbe, and then year after year an ever larger and larger number of substances was added to the list of synthetic compounds. It would take too long to enumerate all the compounds that have been made artificially in the laboratory. It is enough to say that the hydrocarbons of petroleum, common alcohol, wood alcohol, fusel oil, the ethers, the etheral and essential oils, the fatty acids, glycerine, grape sugar and fruit sugar, coloring matters and dye stuffs like indigo and turkey red, aromatic substances like oil of bitter almonds, vanilline and coumarine and many others, have been made.

One hundred years ago it was generally believed to be impossible for two substances of entirely different properties to have the same composition. When Liebig in 1823 found that Wöhler had analyzed silver cyanate and stated the percentage composition, he saw that it was identical with the percentage composition of silver fulminate as found by himself. He at once wrote to Wöhler and told him that he must have made a mistake. Silver cyanate and silver fulminate were very different substances, he said; they could not possibly have the same composition. Wöhler repeated his analyses and found that they were correct. Liebig again analyzed silver fulminate and found that his figures also were correct. Both substances had the same percentage composition. A few years after, Berzelius showed that racemic and tartaric acids have the same composition, but different properties, and from this time on substances of this kind have been called isomeric. This phenomenon of isomerism, so rare at one time, is now very common. We have, for example, 55 substances having the formula $C_9H_{10}O_3$, all having the same elements in the same proportions, or the same kind of atoms and the same number of atoms of each kind. To explain isomerism it was necessary to assume that in these different bodies the atoms are differently arranged or grouped. Thus there came into chemistry the idea of structure or constitution, and by this term is meant the way in which the atoms are united to form the smallest particles of compounds. By studying the methods of formation and of decomposition of compounds it has been found possible to draw conclusions as to which atoms are more closely associated with one another. In the year 1865 the methods of determining the constitution of substances had been brought to a high state of development as the result of the work of Professor Kekulé in Bonn. Kekulé proved experimentally that in a compound each atom is not united directly with all the other atoms, but that certain atoms act like links in a chain and hold different atoms together to form definite structures.

The immediate effect of this theory was that it led to a great deal of work, the object of which was to determine the way in which the atoms are linked in different substances. When once this structure had been determined, it was easy to see how the compound might be built up from simpler substances. The outcome was that hundreds of substances were made synthetically, and in the attempt to make artificially the valuable and useful substances, very often new ones were discovered that in turn were found to possess valuable properties. For instance, after determining the constitution of atropine, Ladenburg, in making it synthetically, succeeded in making several modified atropines, such as homoatropine, which also have valuable properties. Professor Fischer attempted to unravel the

structure of grape sugar and to make it synthetically; he succeeded in this, but, in addition, he has made 20 other sugars that had never been known before.

As work went on in organic chemistry and the methods of working with these substances were improved, and the means of distinguishing between them became more refined, it was found that there were even finer kinds of isomerism than had at first been observed. It is possible to have two or more substances of identical composition and of exactly the same chemical behavior, but differing from one another in only a very slight way. For example one compound will rotate the plane of polarized light a certain number of degrees to the right while the other will rotate the plane the same number of degrees, but to the left. In short there are right and left handed compounds. This physical isomerism, as it is called, can only be explained by assuming a different arrangement of the atoms in space. Since 1888 a great deal of work has been done in the development of the theories of space chemistry or stereochemistry. We are in a position now not only to determine how the atoms are linked to one another but also how they are actually grouped in space. Stereochemistry is the most attractive field of research in organic chemistry to-day. Prominent among the men who have contributed to this department of chemistry are Van't Hoff, Wislicenus, Baeyer and Emil Fischer.

PROGRESS IN PHYSICAL CHEMISTRY.

During the past fifteen years the borderland between chemistry and physics has been very successfully cultivated, and a new department of chemistry has resulted. This is the department known as physical chemistry, and it deals with such subjects as thermo- and electrochemistry, with chemical statics and chemical dynamics and with the laws of solution and electrolytic dissociation. A great deal of progress has been made in all these directions. It is especially the new theories of solution and of electrolytic dissociation that have most profoundly changed our ways of looking at chemical action. We now regard a substance in solution as in a condition analogous to the gaseous state. Like a gas, the dissolved substance exerts pressure, and this pressure, which is known as osmotic pressure, obeys the same laws that gas pressure does. One great practical benefit that has resulted from the laws of solution is that it is no longer necessary to convert a substance into a gas in order to find its molecular weight; it is only necessary to dissolve it in some solvent, and from the changes which it produces in the freezing point or boiling point or vapor tension of the solvent to calculate the molecular weight.

The theory of electrolytic dissociation has greatly modified our ways of interpreting the ordinary reactions of analytical chemistry. We now hold that in all dilute solutions of acids, bases and salts, in short the compounds of inorganic chemistry, we have no longer the unchanged substances, but their positive and negative ions. In the act of dissolving in water the acids, bases and salts are more or less completely split into their ions, and the chemical changes that take place in these solutions are reactions between these ions. A great many facts of analytical chemistry, of electrolysis and such empirical laws as the law of thermoneutrality of salt solutions and of the constant heat of neutralization of acids and bases, heretofore inexplicable, have now received a rational and natural explanation by means of this theory of electrolytic dissociation.

EDWARD H. KEISER.

CAMPANUS.

MANY of the early editions of the 'Elements' of Euclid, among them the *editio prin-*

ceps of 1482, carried a commentary said to be by 'Campanus of Novara.'* That means that everything except the enunciations was by Campanus; for the early notion was that all the demonstrations were the work of editors. Of course that was entirely erroneous and, as far as the first book is concerned, a most monstrous error, since that book is one of the most deeply studied statements that ever was drawn up in any branch of thought.

The Latin text of Euclid which accompanied this commentary had been derived indirectly from an excellent Greek text, decidedly superior to the common traditional text of later times; though in certain details it was faulty. But there are many indications that the translation was not made directly from the Greek, but from the Arabic. There is said to be a 'controversy' as to whether the translation was due to Campanus or not. But as far as I can discover, the 'controversy' consists in this, that everybody who has made any independent inquiry into the matter, such as Tiraboschi and Charles Jourdain, says that the version is that of Adelard of Bath; while the German writers, none of whom have really examined the evidences, either roundly assert that it is by Campanus or decline to enter into what they call the 'controversy.'

The commentary of Campanus is very unequal. In some places, especially in the tenth book, it rises to a high level of mathematical reasoning; while in some other places it is beneath criticism. For the most part, it is very respectable.

Campanus himself has remained an obscure personage. He has usually gone by the name of Campanus, *tout court;* but now and then he has been called Johannes Campanus. It appears that Joannes de Lyneriis, who, about 1310, wrote an 'Abbrieviatio Instrumenti Campani,' so calls him; and there is other XIVth-century evidence to prove that that was his name (see Boncompagni, XVII., 783, 784). In regard to his age, a MS. work of Petrus Peregrinus, to which internal evidence assigns the date 1261, refers to the planetary tables of Campanus (Boncompagni, I., 5), while Roger Bacon is said to speak of him as still living. These facts agree with the assertion of Baldi (whose life of Campano, dated 1588, is given in Boncompagni, XIX., 591), and fully proved by Tiraboschi (Storia della Letturatura Italiana, Tomo IV., Libro II., capo ii., § 8), that he was chaplain of Pope Urban IV., who reigned from 1261 to 1264.

I think that I can fix the date of the commentary upon the 'Elements' within a year or so. In the collection of elementary mathematical works which have been brought together by George A. Plimpton, Esq., there is a manuscript of this commentary upon vellum, written in a very handsome, but stiff and slightly elongated, book-hand, which might have been written at any part of the last half of the XIIIth century, though I think it would be surprising to find that it was as early as 1250. Just below the colophon of this MS., where the owner of such a book frequently wrote his name, one can read in a careful cursive hand of, say, the third quarter of the XIIIth century, or thereabout, a pious sentence in the first person by 'Jacobus Dei gratia Patriarcha Jerusalemitorum.' Observe that one hardly uses the phrase 'Dei gratia' except in speaking of oneself.

It can, therefore, be asserted with considerable confidence that, soon after this MS. was written, it came into the possession of a person so describable. But that could only be Jacques Pantaleone, who, having

* The colophon of the first edition reads: Opus elementorum euclidis megarensis in geometriam artem. In id quoque campani perspicassimi commentationes finiunt. Erhardus ratdolt Augustensis impressor solertissimus venetijs impressit. Anno salutis MCCCCLXXXII Octavis Calendis Junii. Lector Vale. Euclid was always confounded with Euclides of Megara.

been only a short time before elevated to the dignity of Patriarch of Jerusalem, became on the 29th of August, 1261, Pope Urban IV., the known friend of Campanus. He would naturally receive one of the first copies. Indeed, there is evidence that it was hastily given to him ; for the geometrical figures are not drawn all the way through the MS., notwithstanding its being an exceptionally handsome MS., for such a work. It seems, then, that the book must have been published, say, within a year of August, 1260.

If this inference be admitted, we have in the commentary of Campanus, considering its respectable strength, occasionally its remarkable strength, additional evidence of the promising beginning of science which was made in the thirteenth century until all that sort of thing was swept away before the flood of scholasticism ; while in its lapses into utter absurdity, though they are but rare, we meet with another characteristic which is marked in Petrus Peregrinus, in Roger Bacon, and in other scientific students of that period.

C. S. PEIRCE.

P. S. I notice that Moritz Cantor (II., 100) will have it that Urban reigned until 1281. Considering what a difference it would have made for the history of Sicily, for our friend Roger Bacon, and for some famous works of literature, if he had, the slip is, perhaps, worth notice.

When I can have the privilege of examining the MS. again and of consulting a library, I think I can strengthen my proof of the date of the work.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE following is the list of those who have been elected members of the American Association for the Advancement of Science and have completed their membership from January 1 to April 30, 1901. The list includes the names of twenty-six former members and fellows, who have since January 1st been restored to the list by payment of arrearages for more than two years.

Adams, C. C., University of Chicago, Chicago, Ill.

Adams, Frederick C., Teacher of Science, Classical High School, Providence, R. I.

Alderson, Victor C., Dean of the Technical College, Armour Institute of Technology, Chicago, Ill.

Alexander, Chas. Anderson, M.E., 10 Vine St., Batavia, N. Y.

Alleman, Gellart, Ph.D., Instructor in Chemistry, Washington University, St. Louis, Mo.

Alpers, Wm. C., 45 West 31st St., New York City.

Ames, Oakes, Assistant Director of the Botanic Garden of Harvard University, North Easton, Mass.

Appleton, John Howard, Professor of Chemistry, Brown University, Providence, R. I.

Ashmead, Wm. H., Department of Insects, U. S. National Museum, Washington, D. C.

Baekeland, Leo, M.D., 'Snug Rock,' North Broadway, Yonkers, N. Y.

Baerecke, John F., Ph.D., M.D., Professor of Biology, Stetson University, DeLand, Fla.

Bagby, J. H. C., Dept. Physical Science, Hampden-Sidney College, Hampden-Sidney, Va.

Baker, James H., President of the University of Colorado, Boulder, Colo.

Ball, Elmer Darwin, Assistant Professor of Zoology, Agricultural College, Fort Collins, Colo.

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SCIENTIFIC BOOKS.

Topographic Surveying, Including Geographic, Exploratory and Military Mapping. By HERBERT M. WILSON, U. S. Geological Survey. New York, John Wiley & Sons. 1900. 205 Figures.

It is always a source of great satisfaction in picking up a book to know that the author by training and experience is qualified to speak with authority on the subject therein discussed. In the case of the book under review we have as its writer a graduate of one of our best schools of engineering, who afterwards served an apprenticeship under Mr. Henry Gannett, the master topographer, and then, after spending considerable time abroad, became one of the Division Chiefs of the Geological Survey.

Every feature of topographic work is taken up, treated exhaustively, and with the aid of illustrations and tables left in the shape deemed the most serviceable to the student. The descriptions of instruments and their adjustments are scattered through the book and the tables are inserted at the point where reference to them is first made. This is not the usual practice, and its practicability is a question of personal preference. Ordinarily we look in the back of the book for all tables and expect to find the first pages devoted to the description of instruments.

An important topic, seldom referred to, that is found in this treatise is the way in which to equip a party for field work, including the supplies needed, medicines that should be provided, and also suggestions as to how to look after the details of camp life. In this connection it might be suggested that space is given to some matters of trifling importance. However, the severest criticism that suggests itself is the frequent comparison of the work of the U. S. Coast and Geodetic Survey with that of the Geological Survey. This contrasting places the relative accuracy and cost in a misleading light and should not be so presented by an official of either organization. Then, too, the most expensive work of the Coast Survey has been to a great extent experimental, and many organizations have profited by the lessons thus learned—none more so than itself. As, for example, the work of Professor Woodward, which resulted in perfecting the tape-line base-measuring system whereby it was possible for a single party in the Coast Survey to measure nine bases in a single season. A wrong impression is given in comparing cost and accuracy, except when great emphasis is put on the fact that the cost increases rapidly with the accuracy—apparently out of reasonable proportion. If we say that one party can execute a primary triangulation at a cost of 90 cts. a square mile with a probable error of one-tenth of a foot for each side of this square while another charges $30 for a square mile and secures a probable error of three-hundredths of a foot, it looks as though we were paying more than thirty times as much to secure a probable error one-fourth as great. A still greater cause for comment is the statement that while both organizations demand the same degree of precision in precise leveling, one costs $10 a mile, while the other costs only $5.

It is far from the purpose of this review to question the accuracy of these statements, but the opinion is held that such comparisons create wrong impressions and react upon the author. It is believed that the author is in error when he says that in the topographic survey of the District of Columbia no system of bench marks was left in the course of the leveling, also that the St. Albans base was measured with the secondary apparatus, and that any form of tape-stretcher is more quickly manipulated than that used by the Coast Survey. The reason for referring to the matters just mentioned is that in the eyes of many they mar a book otherwise most excellent, and in the main practically beyond improvement.

It is safe to say that there is not a book on topography in the English language, or perhaps in any other language, that gives with such clearness and discrimination the amount of detail required for maps intended for various purposes, and the simplest and quickest methods for securing the necessary data. For this reason it is believed that it is eminently fitted for use as a text-book—a rare quality in technical treatises—as well as for a handbook for those actively engaged in topographic work.

The sketches, diagrams and maps are taken from work actually done, thereby establishing confidence in the processes described. In this connection it might be suggested that a word of caution should be uttered regarding the tendency to give the interval of contours that have been *sketched*. Beyond this one point, a careful reading has not disclosed anything but meritorious features in all that pertains to the technical side of the book.

J. H. GORE.

COLUMBIAN UNIVERSITY.

Neudrucke von Schriften und Karten über Meteorologie und Erdmagnetismus herausgegeben von PROFESSOR DR. G. HELLMANN. No. 13, *Meteorologische Beobachtungen vom XIV. bis XVII. Jahrhundert.* Berlin, A. Asher & Co. 1901. 4vo. Pp. 70 introduction and notes + pp. 130, fac-similes. Price, 18 Marks.

This is the latest of these reprints that have been reviewed from time to time in SCIENCE, and its object is to elucidate the beginning of meteorological observations and to eradicate the impression, which is common even among specialists, that with very few exceptions there were no continuous observations before the end of the 17th century. It is here shown that already at the close of the 15th century many series of observations existed, including some simultaneous ones, and it seems probable that regular observations of the weather were made even in very ancient times. The present volume deals with two kinds of records, meteorological observations on land—those without instruments from 1337 to 1645, and those with instruments from 1649 to 1700—and observations made at sea between 1492 and 1700.

The earliest journal of the weather extant is that kept by William Merle at Driby, in Lincolnshire, England, between the years 1337 and 1344. The Latin MS. was reproduced in facsimile, with a translation, about ten years ago by the late Mr. Symons, but, as the edition was limited and hardly went outside of England, Dr. Hellmann has thought it worth while to reprint a portion. The next oldest record (1439) is also English, and then come German, Austrian, Italian, Swiss, Belgian, Spanish and Danish observations. It is certainly not known generally that observations in Brazil preceded those in this country, and that the first weather observations in North America were by a Swede, Johann Campanius, on the Delaware River, near Philadelphia, during 1644 and 1645, a summary of the weather for each month being given. The first observations with instruments were readings of the barometer each day during the years 1649, 1650 and 1651 in Clermont (Auvergne) and at the same time at Paris and at Stockholm. Of these only M. Périer's observations in Clermont have been preserved and they are reproduced. The original log-book of Christopher Columbus's first voyage (1492–93) no longer exists, but an extract relating to the change of weather on this side of the Canary Islands, and an account of a West India cyclone encountered on the return voyage, and which is the first description of such a storm, are quoted. There are nine other extracts from logs of early voyages, making, with the observations on land, 36 rare journals. Even if known to students, hitherto these have been practically inaccessible, but now they are presented as nearly as possible in the original form and enriched with copious notes by the best authority on the subject. These reprints have not been put on sale in America, but one or two copies of the current volume may be had at the publisher's price, viz., $4.50, from the Blue Hill Observatory, Hyde Park, Mass.

A. LAWRENCE ROTCH.

Die Pflanzen-Alkaloide. Von JUL. WILH. BRÜHL, Professor an der Universität Heidelberg; in Gemeinschaft mit Edward Hjelt und Ossian Aschen Professoren an der Universität Helsingfors. Mit Eingedruckten Abbildungen. Braunschweig, F. Vieweg und Sohn. 1900. Mk. 14.00.

The discovery of plant alkaloids belongs to the early part of the nineteenth century, and their subsequent study and investigation rank among the important achievements of modern chemistry. In 1803, Derosne, a French apothecary, obtained impure morphine from opium. In 1805, Sertürner, a German apothecary, isolated the pure alkaloid and, in 1817, recognized its basic character and showed it to be the active principle of opium. Since that time the study of alkaloidal chemistry has been steadily pro-

gressing, until from certain plants, as cinchona and poppy, at least twenty different alkaloids have been obtained.

The present monograph is a separate edition of Volume VIII. of 'Roscoe & Schorlemmer's Lehrbuch der organischen Chemie,' and treats of the plant alkaloids apart from the synthetic alkaloids and ptomaines. The author has divided this class of the alkaloids into certain fundamental groups, but has wisely not attempted to extend the classification further, having subdivided them according to the plants or families in which they occur. The main divisions are as follows: I. PYRROLIDIN GROUP, hygrine. II. PYRIDIN GROUP, trigonellin, piperin, chrysanthemin, nicotin, sparteine and cytisin, alkaloids of the Solanaceae, jaborandi, areca nut, conium, coca leaves and bark of the root of pomegranate. III. CHINOLIN GROUP, cinchona, strychnos and curare alkaloids. IV. ISOCHINOLIN GROUP, alkaloids of opium, hydrastis, berberis and corydalis. V. ALKALOIDS OF UNKNOWN CONSTITUTION as in ergot, Lycopodiaceae, Coniferae, Gnetaceae, Liliaceae, Apocynaceae, Aristolochiaceae, Buxaceae (Cactaceæ), Lauraceae, Papilionaceae, Loganiaceae, Papaveraceae, Ranunculaceae, Rubiaceae, Rutaceae, and including glyco-alkaloids and other miscellaneous alkaloids.

Of the more than one hundred alkaloids, the constitution of only a comparatively few is known. In his treatment of these principles, Professor Brühl gives the following data concerning them: History, occurrence, preparation or method of isolation, physical and chemical properties and, wherever possible, the constitution, synthesis and the salts which have been studied.

Concerning the origin and purpose of the alkaloids in plant life, the author seems to agree with Guareschi that they are in the nature of waste products of the living protoplasm and that when once produced they are not again assimilated. It may be said, however, that this view is contrary to the recent researches of Barth, who has shown that in the seeds of *Datura stramonium* L. and *Conium maculatum* L. the alkaloids are located in the nucellus and that after germination they disappear. It would appear, therefore, that they, in some instances at least, like the glucosides, are to be considered in the nature of reserve products. Then, too, the recent discovery of the glyco-alkaloids seems to favor this view.

The author has shown a masterly treatment of the chemistry of the plant alkaloids and the book is welcome as an important contribution to the subject; it is not only of special interest to the chemist and apothecary, but also to the physician, more particularly the therapeutist, as it is being shown that the constitution of chemical compounds has a more or less definite relation to physiological action.

HENRY KRAEMER.
PHILADELPHIA COLLEGE OF PHARMACY.

ENZYMES AND THEIR APPLICATION.*

A VOLUME of 217 pp., 8vo, has recently been added to l' Encyclopédie Scientifique des Aide-Mémoire, by M.-E. Pozzi-Escot, editor of the Revue Générale de Chimie pure et Appliquée, on the subject of enzymes and their application. The book is written, as the author states in the preface, for engineers and chemists, and not for biologists. The first part of the book, including nine chapters, deals with the general problems of enzymology, classification of enzymes, secretion, chemical composition, general properties, mode of action, etc. There are some statements in the text which physiologists at least could hardly accept as facts without more proof—for example, on p. 9, that enzymes are transformed vegetable albuminoids, or on p. 17, that enzymes are immortal, and on p. 50, that the secretion of diastase depends simply on the food furnished the cell, etc. The writer's use of the word diastase is also inconsistent. Following Duclaux he uses it most often as a general term equivalent to enzyme, but on pp. 42–43 it is used as equivalent to amylase. On p. 50 amylose is used when amylase was evidently intended, also rhamnose where rhamnase was intended (p. 28). Similar typographical errors are painfully numerous.

The second part of the book deals with enzymes in their industrial applications. This, like the first part of the book, is too briefly dealt

* 'Les Diastases et Leurs Application,' par M.-E. Pozzi-Escot. Gauthier-Villars-Masson et Cie., Paris, 1900.

with to make it valuable as a handbook, but the work will serve a good purpose in stimulating a desire on the part of the reader to know more of the subject and lead him to examine some of the more complete works.

ALBERT F. WOODS.

THE CYCLOPEDIA OF AMERICAN HORTICULTURE.*

IT is scarcely a year since the first volume of Bailey and Miller's Cyclopedia of American Horticulture appeared. The third volume, bringing the work down to page 1486, has now come from the press, and there is reason to hope that the concluding volume will not be delayed much beyond the end of the summer. Considering the large number of persons who have written 'copy,' the many illustrations to be selected and prepared, and the extent of the work, this promptness of publication is not only deserving of commendation but quite remarkable.

What has been said of the quality of the earlier volumes (SCIENCE, June 1 and August 10, 1900) applies equally to the one now under consideration. Perhaps the general reader will be most interested in the excellent brief horticultural treatment of the States the names of which begin with N to P—therefore comprising most of the great horticultural States of the country—and of the Philippines and Porto Rico, and in the articles on parks, perfumery gardening, photography as applied to horticulture, physiology of plants, plant breeding, and the correct methods of potting and pruning plants. The most extensive botanical monographs are those of *Opuntia*, *Pinus*, *Populus*, *Prunus*, *Pyrus* and *Quercus;* and the most important horticultural monographs, aside from some of these, are those of the Orange, Peach, Pear, *Pelargonium*, Pecan and *Primula*.

T.

SOCIETIES AND ACADEMIES.

THE AMERICAN PHYSICAL SOCIETY.

AT the meeting of the Society, held at Columbia University, on April 27th, Professor A. A. Michelson, of Chicago, was elected president to fill the vacancy caused by the death of Professor H. A. Rowland, and Professor A. G. Webster, of Clark University, was elected vice-president. The following resolution was adopted and made a part of the minutes:

The Physical Society desires to record its deep sense of sorrow for the death of its late president, Professor H. A. Rowland, and its appreciation of his services to science. By his brilliant researches he did much to advance our knowledge of physics, and by his work as a professor he stimulated many students to greater zeal for accurate scholarship and scientific investigation. His interest in the Society was shown from its beginning, and it owes much to the care with which he watched over the organization. By his death the Society, the science which it represents, and our country have sustained a loss which will be severely felt.

At the same meeting of the Physical Society Professor S. W. Stratton gave an account of the organization of the National Bureau of Standards which is to be established at Washington, and which, it is hoped, will prove of great value both to the scientific workers of the country and to manufacturers.

A paper by Mr. Bergen Davis on a 'New Phenomenon produced by Stationary Sound Waves' described some interesting quantitative experiments with organ pipes. The apparatus and methods employed by Mr. Davis gave results in close accord with what theory would predict, and they make it appear possible to bring the experimental study of these subjects on to an exact quantitative basis.

Mr. H. J. Hotchkiss presented a paper on the 'Counter E. M. F. of the Electric Arc,' giving an account of an experimental study of one phase of this much-discussed question. Mr. Hotchkiss employed an oscillograph, of a type which he has developed and used in numerous previous investigations, to determine whether the arc contains a counter electromotive force which lasts for an appreciable time after the current has been removed. The period of the needle of the oscillograph was about 1/5,000 of a second, and a study of the curves obtained by it has led Mr. Hotchkiss to the conclusion that if a counter electromotive force does exist, which lasts as long as a ten-thousandth of a second after the current is broken, then the

*Bailey, L. H. and Miller, W. Cyclopedia of American Horticulture. N–Q. Pp. xv + 432. Pl. 11 + ff. 606. New York, 1901. The Macmillan Company. Price, $5.00.

average value of this E. M. F. cannot exceed $\frac{2}{3}$ of a volt. The paper also described experiments to determine the conductivity of the arc after the circuit was broken. The conductivity was found to depend upon the direction in which current was sent through the arc, and the results seem to indicate something in the nature of a counter E. M. F., whose value is less than one volt.

Professor A. G. Webster showed a method by which the Maxwell top might be used to indicate the path of the invariable axis in a body moving under the influence of no forces. A second paper by Professor Webster described quantitative experiments with a top. The traces obtained from the top under various known conditions were found to agree satisfactorily with the predictions of theory.

A paper by Professor E. L. Nichols on the 'Efficiency of the Acetylene Flame' gave the results of experiments on this subject since the presentation of Professor Nichols' previous paper in June. The values obtained at that time have been only slightly modified by the later work.

A paper on the 'Specific Heats of Electrolytes,' by Professor W. F. Magie, gave a formula for computing the specific heat in the case of solutions in which electrolytic dissociation occurs. A comparison with experimentally determined values showed an extremely satisfactory agreement.

A paper by Mr. J. W. Miller, on the 'Elastic Properties of Helical Springs,' describing numerous experiments on this subject, completed the program.

ERNEST MERRITT.

CHEMICAL SOCIETY OF WASHINGTON.

THE 126th regular meeting was held April 11th, when the following program was presented:

'A New Method for the Estimation of Cane Sugar, in presence of Lactose,' by L. M. Tolman. Benzolsulphinide was used as the hydrolyzing agent, because it has no action on the rotation of lactose, even after heating for several hours, while a solution of sucrose is completely inverted in 30 minutes, by use of one-half gram of the sulphinide. The results obtained showed that it was a satisfactory and accurate method. The method used in condensed milk was as follows: Twice the normal weight of the milk was weighed into a 200-cc. flask and 10 cc. of a 10-per-cent. solution of citric acid added to coagulate the casein. The liquor was then filtered, 75 cc. of the filtrate measured into a 100-cc. flask, one half gram of saccharine added and, after shaking, in order to break up the lumps, immersed in a boiling water bath for 30 minutes. Two cc. of acid mercuric nitrate were then added, the solution made up to volume, filtered and polarized at as near 20° C. as possible. The direct reading was taken in the ordinary way and the volume of precipitate corrected for by double dilution. The results obtained were very satisfactory.

'Classification of Alkali Soils,' by Frank K. Cameron. The views presented in this paper may be summarized as follows: (1) A classification as black alkali or white alkali, depending upon the presence or absence of sodium carbonate, is inadequate in view of our present knowledge of alkali phenomena. A more comprehensive classification is desirable. Such a classification appears to be possible on chemical grounds, considering alkali conditions as the result of the action of aqueous solutions of certain soluble salts upon less soluble salts. (2) The action of sodium chloride solutions upon gypsum is the predominating feature in certain areas and seems to be well typified by the conditions in the valley of the Pecos in New Mexico. The solubility of the gypsum is apparently much increased by the presence of the sodium chloride due to the formation of the soluble salts, sodium sulphate and calcium chloride. In such an area practically the only salts which will have to be considered in the ground solutions are sodium chloride and sodium sulphate, as well as calcium sulphate. Calcium chloride is sometimes found concentrated to a considerable extent, but usually in localized and generally small spots. Owing to its keeping the soil of these spots moister and, therefore, darker than the surrounding soils, such spots are locally known as black alkali spots. (3) The action of solutions of sodium chloride upon calcium carbonate is the predominating feature of some areas. The region about

Fresno, Cal., seems to furnish a good illustration of this class. As a result there is always found a greater or less formation of sodium carbonate, the soluble and very noxious component of black alkali, and the very soluble calcium chloride. Such regions are generally further characterized by the presence of a hardpan at a distance of a few feet below the surface and generally parallel to it, the cementing material of which is calcium carbonate. In such areas there is a tendency toward an accumulation of the soluble carbonates at the surface of the soil. Calcium chloride accumulations, in spots of comparatively restricted area, are frequent accompaniments and are often mistaken for bad black alkali spots, although the presence of soluble carbonates in more than very small quantities is an impossibility. (4) The class of alkali most commonly encountered is that in which the predominating feature is the simultaneous action of solutions of sodium chloride upon gypsum and calcium carbonate. In such an area the formation of soluble carbonates can take place to only a very limited, generally negligible, extent. The apparent increase in the solubility of the gypsum is also much less than when the calcium carbonate is not present. The alkali of the Salt Lake Valley appears to be a good illustration of this type. (5) Much less frequently other types of alkali are encountered, as at Billings, Mont., where the soluble material in the soils appears to be almost entirely sulphates. (6) Modifications of the types described above are more or less frequently found. They may possibly be of such importance as to warrant a separate classification, as, for example, the conditions found to exist in the valley of the Sevier, Utah. (7) The classification here proposed is believed to be comprehensive and is founded on scientific principles. It is elastic and will readily admit of modifications. Principles other than those now recognized in it may be introduced without the accompaniment of radical changes. It can be made as specific as the advance of our knowledge from time to time will justify.

'Chemical Examination of Alkali Soils,' by Atherton Seidell. In this paper the author pointed out the necessity for uniform methods in the examination of the water-soluble compounds of alkali soils, in order that the work of various investigators may be compared. A description of the procedure and methods in use in the U. S. Department of Agriculture was given, with a full discussion of the basis therefor. The unique features are the preparation of the solution for analysis, the preliminary determination of the salt content, by means of the electrolytic bridge, and the determination of carbonates, bicarbonates and chlorides. The statement of the results was also discussed at length.

L. S. MUNSON,
Secretary.

THE ONONDAGA ACADEMY OF SCIENCE.

THE 46th regular meeting of the Society was held in the Historical Rooms, on April 19, 1901.

The first paper was by Professor J. D. Wilson, entitled 'The Fauna of the Goniatite Limestone.' In most places this formation consists of two layers of rock scarcely more than two feet in thickness, but exceedingly rich in goniatites and other cephalopods. He had collected 18 varieties of goniatites, orthocerata, and related forms, nearly all of them confined to the upper layer of limestone. Recently he had found several specimens, one a coiled form, evidently related to *Gyroceras transversum*, and ornamented with nodes, but having a cross section distinctly decahedral. The name *Thoracoceras Wilsoni* is suggested. In the discussion Professor Philip F. Schneider called attention to a much smaller and less prominent fauna of the limestone, which is principally confined to the lower layer. It consists of 3 gasteropods, 2 pteropods, 1 brachiopod and 1 trilobite, thus increasing the list to 25 specimens.

The second paper, entitled 'Recent Theories as to the Cause of the Glacial Period,' was given by Dr. T. C. Hopkins of Syracuse University. He spoke briefly of several of the recent theories and carefully described the 'Atmospheric Theory.' This theory is based on the principle that slight variations in the amount of carbonic acid and watery vapor present in the atmosphere produce grave changes in its temperature, and he would entirely account for the great differences in the tempera-

ture of the past in this manner. The detail of the theory resolves itself into a question of accounting for the differences in the amount of carbonic acid present, all of which was carefully worked out and described by Dr. Hopkins.

A plan for the federation of all local societies with kindred interests was favorably discussed.

PHILIP F. SCHNEIDER,
Corresponding Secretary.

THE BACONIAN CLUB, STATE UNIVERSITY OF IOWA.

THE following formal papers have been read during the current year:

'Forestry in Iowa': Assistant Professor B. Shimek.

'The Extent and Significance of Food Adulterations': Dr. E. W. Rockwood.

'The Geology and Scenery of the Pipestone Region': Professor Samuel Calvin.

'Some Features of the Architecture in Westminster Abbey': Dr. J. G. Gilchrist.

'Jelly Fishes and their Relation to the Hydroid Colony': Professor C. C. Nutting.

'Three Famous Problems in Geometry': Dr. J. V. Westfall.

'A Sketch of the Geology of Canada': Mr. R. D. George.

'The Rôle of Insects in the Spread of Diseases': Dr. W. L. Bierring.

'The Mechanics of a Harp String': Professor Laenas G. Weld.

'Concerning the Scope of University Training': Professor Launcelot W. Andrews.

'The Psychology of Profanity': Professor G. T. W. Patrick.

'The Lost Art of Wood Engraving': Mr. John Springer.

'Some Features of the Road Problem': Professor A. V. Sims.

'The Inscribed Polygon of Seventeen Sides': Assistant Professor Arthur G. Smith.

'The Sympathetic Relation of the Two Eyes': Dr. F. J. Newberry.

'Measurement by Light Waves': Mr. Charles F. Lorenz.

'The Pecuniary Economy of Foods': Mr. A. M. Goettsch.

'Twentieth Century Protoplasm': Professor T. H. Macbride.

'The Psychological Theory of Organic Evolution': Dr H. Heath Bawden.

'Photographic Optics': Professor A. A. Veblen.

'The Modern Theory of Solution': Dr. Carl von Ende.

'Railroad Construction': Mr. W. D. Weeks.

'The Causes of Blindness in Iowa': Dr. L. W. Dean.

Several of the above papers were original contributions to science and have been or will be published.

Among the voluntary reports that have been given during the year the following deserve mention as first announcements: December 7, Professor C. C. Nutting reported on the discovery of a new method of reproduction among the hydro-medusæ. The hydranth has been seen to proceed from the proboscis of the medusa, by a process of budding. December 14th, Professor A. A. Veblen exhibited a new copying-camera table which is capable of all needed adjustments. January 4th, Dr. J. G. Gilchrist reported upon the successful treatment by trephining of three cases of epilepsy of long standing. February 15th, Professor Launcelot W. Andrews exhibited a model to illustrate the process of electrolysis. The same model illustrates Faraday's law of the decomposition of chemical substances. April 26th, Miss Mabel Williams reported the discovery of 'the area-volume illusion,' according to which any dimension of a surface seems larger than the corresponding line and one face of a volume seems larger than the corresponding plane surface. The speaker has demonstrated that the illusion is due to the presence of the judgment 'there is more of it,' which exerts a subconscious influence in the perception. October 12th, the secretary exhibited a new ergograph, and April 19th, new apparatus employed in the study of the voluntary control of the pitch of the voice in singing and speaking.

C. E. SEASHORE,
Secretary.

THE ACADEMY OF SCIENCE OF ST. LOUIS.

AT the meeting of the Academy of Science of St. Louis on the evening of May 6th, twenty-two persons present, Mr. C. F. Baker presented an embryological demonstration, including gross and microscopic specimens, covering the development of the chick during the first forty-eight hours of incubation, intended to illustrate a working course in embryology for high schools.

One person was elected to active membership.

WILLIAM TRELEASE,
Recording Secretary.

ELISHA MITCHELL SCIENTIFIC SOCIETY.

AT the 135th meeting of the Society on May 4th, the following papers were read:

'Transit Methods for Laying Sewer Grades': Mr. Wm. Cain.

'Acid Crystallization': Mr. Charles Baskerville.

'The Probable Complexity of Thorium': Mr. Chas. Baskerville.

'The Recent Geological Formations of the Mississippi Valley': Mr. J. A. Holmes.

CHAS. BASKERVILLE,
Secretary.

DISCUSSION AND CORRESPONDENCE.

THE LARYNX AS AN INSTRUMENT OF MUSIC.

TO THE EDITOR OF SCIENCE: In this week's number of SCIENCE Professor Joseph Le Conte remarks upon Professor Scripture's description of the mode of action of the vocal chords, and quotes from a work of his own to show that the larynx 'cannot be likened to a stringed instrument nor to a reed-pipe,' continuing, "It is strange that no one has thought to liken it to an ordinary horn; a stage horn, or better, a French horn."

In Helmholtz's 'Tonempfindungen,' of which the first edition was published in 1862, occurs, under the caption, 'Membranöse Zungen,' the following statement: 'Als musikalische Instrumente kommen nur zwei Arten solcher membranöser Zungen in Betracht, nämlich die menschlichen Lippen beim Anblasen der Blechinstrumente und der menschliche Kehlkopf in Gesange.'

This is the exact comparison suggested by Professor Le Conte. There follows a minute description of the mode of action of the vocal chords, and of the action of the lips in blowing a horn, which has never needed any improvement or correction. Both these cases are, very properly as it seems to me, classified under reed pipes, the sorts of reeds described being of great variety. The model pictured at the head of the section, for the study of membranous reeds, is certainly, as I think will be admitted by anyone who has made one, a very convincing demonstration of the mode of action of the larynx. Professor Scripture's elastic cushions are certainly to be classified as reeds.

ARTHUR GORDON WEBSTER.

CLARK UNIVERSITY, May 17, 1901.

THE NEW COMET.

TO THE EDITOR OF SCIENCE: In SCIENCE for May 3d, page 717, appears an announcement of the discovery of the new comet, to which is added a section, stating that Professor Frost, of the Yerkes Observatory, had observed the comet on the morning of April 27th, just before sunrise. The last number of the *Astronomical Journal* also contains a similar statement, saying the comet was seen by him 20 minutes before sunrise, half an hour afterwards, and 15° north of the sun.

Here at the Naval Observatory two of the computers, and also I, myself, hunted diligently for the comet, both in the morning and evening, for several days after the receipt of the first telegram, and until we had positive information on the direction of motion.

Now that a set of elements of the comet has been received, it is perfectly clear that whatever Professor Frost sighted on April 27th, it was not the comet. On that day the object was 13° *south* of the sun, and very close to it in right ascension.

Moreover, as seen from the Yerkes Observatory, it would not rise until about 40 or 45 minutes after the sun, as any one can easily demonstrate by computing the place of the comet for that day, the semi-diurnal arc for it and the sun, for Yerkes Observatory, and take the difference between those two quantities.

GEORGE A. HILL.

NAVAL OBSERVATORY, WASHINGTON,
D. C., May 16, 1901.

THE TEACHING OF PHYSIOLOGY IN THE PUBLIC SCHOOLS.

ABOUT two years ago I wrote a letter for SCIENCE concerning the text-book in physiology adopted by the State Board and used throughout the public schools of Kansas. Much dissatisfaction has been expressed by the more intelligent teachers of the State, but there is, nevertheless, no redress—the book must be used as a text in every school in the State.

The results may be inferred. I can exemplify them no better than by giving some of the actual answers to questions in physiology by high school candidates who had just been passed in physiology in the grammar grades.

'Pleurisy is a disease of the skin'—'an indication that some nerve has been affected.'

'Alcohol, tobacco and opiates thicken the blood of the nerves.'

'The respiratory center is in the heart.' 'The heart is the center of respiration.'

'Residual air is the air in the heart.'

'The body should be bathed frequent'—'should be bathed at least once a year.'

'Appendicitis and pleurisy is a condition of the throat.'

'The blood is carried to the liver through the right and left auricles.'

'The meatus auditorius is in the intestines'—'is an artery leading from the heart'—'is in the eye'—'is a tube in which the blood passes through before entering the stomach.'

'The patella is a network of small blood vessels'—'is the lining of the abdomen'—'is a tube in the chest'—'is a muscle over the knee.'

'The motores oculi is in the veins'—'is an organ of voice.'

'The mitral valve is at the lower end of the stomach'—'is located in the liver.'

'Excretion is mingling with saliva,' etc., etc.

Such absurdities are by no means rare in the Kansas schools. For several years it was the writer's duty to pass upon the papers in physiology of candidates for the State teachers' certificate, and many answers as ridiculous as any of the above, were observed. Thus: to the question 'Why does the human body cease to grow in stature after about the twenty-fifth year?' the reply was almost invariably, 'Because it has got its full growth.' Four out of fifteen answered the question as to what the lymphatic system is by saying that it is a system of vessels that take up the impurities of the blood and discharge them into the kidneys! It was the rare exception that the papers came up to the standard of a respectable high school.

The worst of it all is that many intelligent people defend such ignorance by saying that you must not expect teachers in the public schools to be experts in physiology. Is it not time that such 'science' is banished from the public schools? I do not know whether Kansas is an exception in this particular, as it is perhaps in some others, to the other States of the Union. Certain it is, however, that such defects cannot be ascribed to the public school system of the State in general, for I honestly believe that this stands on a higher plane than in a majority of the other States. Is public school physiology everywhere a farce?

S. W. Williston.

SHORTER ARTICLES.

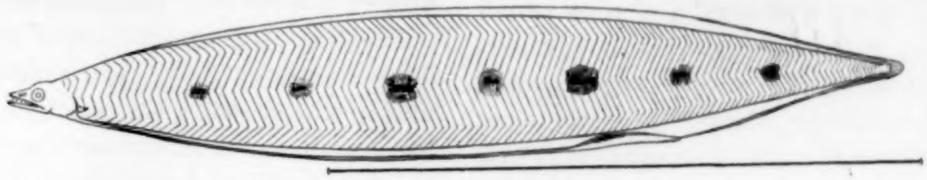
UNILATERAL COLORATION WITH A BILATERAL EFFECT.*

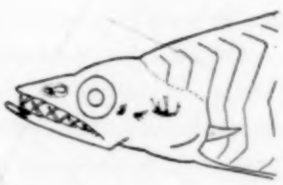
While describing the larval eels or Leptocephali belonging to the United States National Museum two specimens claimed especial attention. Structurally these two specimens are very different and might readily be referred to distinct species. In one the nares are approximated, and the pectorals are well developed, in the other the nasal openings are wide apart and the pectorals have disappeared. The index that pointed to the probability that the two specimens were different stages of the same species is their unique coloration. There are eight large black spots much larger and much more conspicuous than the color markings of any other Leptocephalus. One of these is located over the alimentary canal a short distance in front of the anus. The others are along the side. Each one of these spots is formed by a single enormous chromatophore extending laterally over three or four somites. Sometimes a few minute chromatophores are to be found at the margin of the large one. There are three of these large chromatophores on the left side of the body and four on the right. In each case the spots of one side are arranged at irregular intervals, but in both cases the spots of the one side alternate with the spots of the other side, so that together they form, even in the alcoholic specimens of these transparent

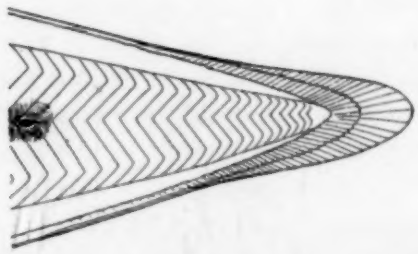
* Contributions from the Zoological Laboratory of the Indiana University, No. 45.

creatures, a series of seven spots placed at nearly regular distances along the middle of the side. The effect is precisely the same as if the seven spots were repeated on the two sides.

In opaque animals the color markings of the two sides approach bilateral symmetry. In the present case the markings are strikingly asymmetrical in that there are three spots on one side and four on the other. This asymmetry in the number of spots on the two sides and their positions at irregular distances from each other makes it quite certain that their arrangement







on opposite sides so as to alternate and form a series at more or less regular intervals is not accidental but the normal condition, *i. e.*, a mutual adaptation in the location of the spots of the two sides. This adaptation of the two sides to each other is emphasized in the younger specimen where the first two spots are on the right side, leaving the first forty segments of the right side without a spot.

The following are the details of the distribution of the spots on the somites, counting from the pectoral backwards:

Number of segments between the centers of successive spots.	Number of the segments and the sides on which the spots occur.
YOUNGER SPECIMEN:	
12	15–16–17 R
13	27–28–29 R
11	40–41–42 L
11	51–52–53 R
14	62–63–64–65 L
15	76–77–78 R
	91–92–93 L
OLDER SPECIMEN:	
12	12–13–14 R
12	24–25–26 L
12	36–37–38 R
10	48–49–50 L
13	58–59–60 R
17	71–72–73 L
	87–88–89–90 R

The two specimens differ structurally as follows:

A. Body more elongate than in *AA*; pectorals a mere ridge; nostrils remote from each other for a distance nearly equal to the diameter of the eye; leptocephalous teeth wanting; lower jaw projecting, its tip rounded and entering the profile; no pigment spots about the head; depth $8\frac{3}{5}$ in length, head distinctly more than half the depth of the body, nearly 11 in the length; eye 7 in head, $1\frac{1}{2}$ in snout; segments 73 + 43. One specimen 51 mm. long. New Providence (type).

AA. Body elliptical: pectorals well developed: nostrils not yet separated: leptocephalous teeth: jaws nearly equal: a pigment spot near the end of the lower jaw, another within anterior nares, two succeeding each other between the lower margin of the pupil and the lower margins of the auditory capsule: depth 6 in the length: head little less than half greatest depth: eye five in head: segments 76 + 38.

One specimen 38 mm. long. Albatross Station 2566.

The *Leptocephalus* has not been referred to

its adult form and may be termed *Leptocephalus diptychus*.

C. H. Eigenmann,
Clarence Kennedy.
University of Indiana.

VELOCITY OF IONS FROM ELECTRIC ARCS AND FROM HOT WIRES.

Much interest is being shown at present concerning ionization of gases and 'electron' theories of electricity. An investigation now in progress promises to throw further light on this subject, in fact to change one idea which has been held. It has been stated by eminent authorities that in the case of discharge through gases the negative ions always go faster than the positive under the same conditions. The present investigation shows that this is not always the case and a brief account of it may not be amiss.

The work had its origin in an attempt to explain the phenomena of the electric arc. It was shown in the *Physical Review** that all the phenomena of the arc could be explained by assuming, first, that the current in the arc was carried by ions, and second, that the positive ions move the more rapidly. The second part of this hypothesis did not at first seem probable, since in all cases which had previously been investigated the negative ions had been found to move the more rapidly. Two sets of experiments were, however, given as tending to substantiate that hypothesis, but neither of them could be considered conclusive.†

More recently experiments have been performed with ions drawn out from an arc by a charged body in the neighborhood.‡ The positive ions in this case were found to have the greater velocity. Quite recently the same fact has been shown by an application of a method used by Zeleny * for finding the velocity of ions produced by X-rays. These methods are entirely independent and the agreement of the results in the two cases leaves little reason to doubt the correctness of the conclusion that the positive ions here move the more rapidly.

* *Phys. Rev.*, 10, 151.

† Since publishing the above-mentioned article I find that part of the work there described had already been described by Dewar (*Chem. News*, 45, 37). My own work was performed without knowledge of that done by Dewar, and the method used was not the same as his. The results of the two investigations agree fully. The explanation of the results offered by myself was not suggested in his article.

‡ *Phys. Rev.*, 12, 137.

Of course, this is not a proof that the positive ions in the arc itself move more rapidly than the negative, but since such an assumption would explain the phenomena of the arc and since the positive ions just outside the arc do have the greater velocity, it seems reasonable to assume that they do also within the arc.

It opens up, however, a still more interesting field of inquiry, *i. e.*, that concerning the condition under which the positive ions show this peculiarity. The discharge from hot platinum and iron wires was accordingly investigated. It has long been known that positive electricity escapes from hot metals easier than negative. An examination of the velocity of the ions from the hot metals showed that here also the positive ions move the more rapidly. Both the methods used in the previous investigation led to the same conclusion.

But in all these cases the action is complicated by the fact that both gases and solids are present. For example, in the case of discharge from hot platinum wire atoms of platinum are no doubt given off, since it is a well-known fact that platinum wire when heated to a white heat decreases in weight.† It may be that because of some contact difference of potential the negative ions of the metal never escape from the metal. A comparison of positive ions of one substance with negative of another would not be of great value. One would wish to know whether the positive ions move faster than the negative ions from which they have been separated.

The case of the arc is still more complicated, for many different solid and gaseous substances enter into the arc. The investigation by Arons ‡ on the arc between metals in H and N at different pressures shows that both the terminals of the arc and the gases about it must be considered.

* *Phil. Trans. Roy. Soc. Lon.*, 195, 193.

† *Wied. Ann.*, 37, 319.

‡ *Drude Ann.*, 1, 700.

Fortunately one case has been studied which is not thus complicated, *i. e.*, the arc in mercury vapor between mercury terminals. In this case only one element is to be considered, and here Arons* found that the greater fall of potential was at the anode. In the light of the work now described we may interpret this to mean that the positive ions in such an arc move the more rapidly.

Warburg† found that in case of discharge in a vacuum tube containing some mercury vapor the fall of potential at the cathode was approximately the same as it was in nitrogen. Arons in discussing this calls attention to the fact that when discharge is taking place through a gas the greater fall of potential is at the cathode, when through a metal vapor at the anode. Possibly we may now modify this statement and say that when *gases are ionized the negative ions move the more rapidly, but that when metal vapors are ionized the positive ions move the more rapidly.* All the facts that have thus far been observed could be explained by such a hypothesis. If this should be shown to be correct, it will no doubt lead us to modify somewhat our ideas concerning the relation of metals to electricity.

C. D. CHILD.

* *Wied. Ann.*, 58, 78.

† *Wied. Ann.*, 40, 10.

MODULUS OF CONSTANT CROSS SECTION.

THE longitudinal rigidity of a solid, represented by Young's modulus, depending as it does upon both the volume elasticity and simple rigidity, leaves one condition unprovided for *viz.:* the case of longitudinal extension with cross section remaining unchanged. This case probably does not occur with an unrestricted stress, but it is easily conceived in theory. I can find no mention anywhere of a modulus of constant cross section, and have undertaken to approach the problem in this wise. Add to Young's modulus that fraction of the simple rigidity represented by Poisson's ratio. This preserves the longitudinal rigidity and restores to the new modulus the numerical measure of that portion of the strain called out by the change in lateral dimensions.

If this be a true modulus, it offers an easy method of determining approximately the mechanical equivalent of heat, and provides a practical experiment for laboratories not supplied with costly and complete apparatus. Thus a brass wire of density 8.5 ; sp. heat, of .09, coefficient of expansion .000018, volume elasticity 10×10^{11}, simple rigidity 3.7×10^{11}, and Young's modulus 10.4×10^{11} gives roughly,

$$\frac{\left[10.4 \times 10^{11} + \left(\frac{22.6}{67.4} \times 3.7 \times 10^{11}\right)\right]\frac{1}{2} \times .000018}{\frac{8.5 \times .09}{3}} = 4.1 + \times 10^{7}$$

as the value of the calorie in C. G. S. units.

BENJ. H. BROWN.

NOTES ON INORGANIC CHEMISTRY.

WITHIN the past few years much has been added to our knowledge of the chemistry of the alums. To the aluminum, chromium, iron, gallium, and indium alums have been added those of titanium, vanadium, manganese, and cobalt. This completed the series of alums of the metals of the period from titanium to cobalt, but beyond this no alums were known of metals outside of the third group. In the last number of the *Zeitschrift für anorganische Chemie* Professor Piccini of Florence, the discoverer of the titanium and vanadium alums, has described a series of rhodium alums, including those of potassium, ammonium, rubidium, cesium and thallium. This is of peculiar interest, since rhodium belongs to a period in which no alums have been known, and opens the question as to whether there may be other alums in the same period, which includes molybdenum and columbium. Piccini is at present endeavoring to form iridium alums, which the preparation of the rhodium alums makes seem possible.

IN a paper in the last *Berichte* of the German Chemical Society, on radio-active lead, Professor K. A. Hofmann of Munich and Eduard Strauss describe two new substances which appear to be new chemical elements. Both are found in the lead chlorid obtained from pitchblende, and are separated from the lead by fractional crystallization. The one substance possesses no radio-activity and resembles some-

what ruthenium. Its combining weight is 50.46, and hence if bivalent it would have an atomic weight of 100.92. In this case it would be the missing eka-manganese, but the authors put this forward merely as a suggestion, pending a more thorough investigation. That which would tell most strongly against this supposition is the fact that the new substance forms a white sulfate which is insoluble in water and in dilute sulfuric acid, and stable up to a temperature of 400° to 500°. The second new substance described by Hofmann and Strauss is found in the lead chlorid, both from pitchblende and from bröggerite. This substance is radio-active, though the authors express doubt as to whether the activity of the lead from these minerals is due solely to the presence of this new substance. It appears to have a combining weight of 86, from which an atomic weight of 172 would follow, provided the metal is, as would seem probable from its resemblance to lead, bivalent. It might then be a metal of the fourth group, between tin and lead, and the representative of the period, none of whose members are definitely known. Of the compounds of this element, if such it be, the sulfate alone shows radio-activity. After the action of the kathode rays the substance shows a fluorescence, which lasts for upwards of two minutes.

THE same number of the *Berichte* contains the description by Professor Hoffman and W. Prantl of a new element in the euxenite from Brevig. This euxenite, which is a complex silicate, titanate and columbate of the rare earths, iron, and aluminum, contains about two per cent. of what is supposedly zirconia. Hofmann finds that half of this is a new oxid, differing from zirconia, by its insolubility in ammonium carbonate, its giving no color reaction with curcuma, and having a combining weight of 44.4, which is nearly double that of zirconium. The atomic weight of the new element, if quadrivalent like zirconium, would be about 178. The same mineral seems also to contain another hitherto unknown element, which bears some resemblance to tantalum, but which has not yet been carefully examined.

IN spite of the incredulity with which his claims to convert phosphorus into arsenic and antimony have been received by chemists, Fittica still continues his work upon the subject. In his latest experiments he heats amorphous phosphorus with lead oxid and boron. At 140° water is formed and after heating to 205° the residual mass is found to contain lead sulfate and the borid of nitrogen. If boric acid anhydrid is used in the place of the litharge, water, sulfuric acid and the borid of nitrogen are likewise formed, but also arsenic and sometimes antimony. From these experiments Fittica concludes that amorphous phosphorus is a compound of nitrogen, sulfur and hydrogen, and he assigns to it the formula N_2SH_2. He does not, however, furnish satisfactory proof that this represents the actual quantitative composition of phosphorus. He also admits that when amorphous phosphorus is oxidized with nitric acid no trace of sulfuric acid is formed.

J. L. H.

BOTANICAL NOTES.

INTERNATIONAL BOTANICAL ASSOCIATION.

A CALL, signed by sixteen botanists of Europe and America, has been issued for a meeting of the botanists of the world at Geneva, Switzerland, on the 7th of August next, for the purpose of organizing an International Botanical Association. In the call it is stated that the chief object of the Association will be the foundation of a bibliographic periodical, criticizing in a perfectly impartial manner all botanical publications in such a way that the more important shall be separated from those which are of less value. Other advantages to be derived from the proposed organization are presented, and correspondence with the secretary, Dr. I. P. Lotsy, of Wageningen, Holland, is solicited.

STOCK-POISONING PLANTS.

THE Division of Botany of the United States Department of Agriculture has recently issued a valuable bulletin (No. 26) dealing with the plants which are known to be poisonous, or which are thought to be poisonous to stock in the State of Montana. About twenty-five pages are given to a general discussion of the conditions under which poisoning occurs, and of remedies and their application. Then follow about sixty pages devoted to a few plants of the

greatest importance, viz.: death canas (*Zygadenus venenosus*), larkspurs (*Delphinium* of two species), water hemlock (*Cicuta occidentalis*), loco weeds (*Aragallus* sp.) and lupines (*Lupinus* sp.). The first is said to be the most important of all the plants reputed to be poisonous to stock in Montana. It grows everywhere in Montana in moderately moist places on open ranges, and outside of the State is found from British Columbia to South Dakota, Nebraska, Utah and California. Feeding experiments show that both leaves and bulbs are poisonous. Two species of larkspurs (*D. glaucum* and *D. bicolor*) have attracted the most attention, although other species are more or less under suspicion. The foliage is the poisonous part in these plants. Water hemlock is usually known as 'wild parsnip' and is commonly supposed to be the garden parsnip run wild, an error, of course. The roots and foliage are poisonous, and cases of poisoning of cattle, sheep and even human beings are reported. This species is very much like the eastern (*C. maculata*) in appearance and action. The loco weeds affect animals quite similarly to the related plants called loco weeds on the Great Plains. The species of most importance is *Aragallus spicatus* which is closely related to *A. lamberti* of the Missouri Valley. Several pretty species of lupines (*Lupinus*) are shown to be poisonous. These are locally known as blue peas, blue beans, wild peas, wild beans, etc., and in spite of their pretty flowers are to be placed among the noxious plants. The report devotes about a dozen pages to poisonous plants of less importance, about as many to suspected plants, and closes with a discussion of some species which have been wrongly accused of possessing poisonous properties. Thirty-six plates help to make this a very valuable and useful report.

NORTH AMERICAN FERNWORTS.

ABOUT twenty years ago Professor Underwood issued a little book on the ferns of the country, which has proved to be so useful that it has been revised again and again, its latest title (sixth edition) being 'Our Native Ferns and their Allies.' From time to time it has undergone considerable changes at the hands of its author, and in its latest form this is most marked. Here the results of the latest studies both in morphology and nomenclature have been used to such an extent that the old-time fern collector will often find himself somewhat dazed and confused, unless he has kept himself well informed as to the tendencies of these later years. Thus to find the common brake under the name of *Pteridium aquilinum* instead of *Pteris aquilina;* to find *Phyllitis* substituted for *Scolopendrium; Dryopteris* and *Polystum* for *Aspidium; Filix* for *Cystopteris; Matteuccia* for *Struthiopteris;* and *Dennstaedtia* for *Dicksonia*, is disquieting for the botanist who learned about ferns twenty or more years ago. It shakes one's faith in the immutability of things to find old friends under unfamiliar names. For the peace of mind of such persons it would be well not to buy the later editions of systematic books, for in all of them—even the most conservative—we find many of these tiresome changes.

In a recent paper ('A List of the Ferns and Fern-Allies of North America north of Mexico, with principal Synonyms and Distribution') published by William R. Maxon in the *Proceedings* of the United States National Museum (Vol. XXIII.) our information as to the Fernworts of North America is considerably augmented. While in Professor Underwood's book the total number of entries is 279, Mr. Maxon brings them up in his list to 307. This increase is mostly due to the separate recognition and enumeration of varieties, and in part to the addition of new species and varieties. Among the new species are *Polypodium hesperum*, from western United States; *Adiantum modestum* from New Mexico; *Dryopteris aquilonaris* from Alaska; *Isoetes heterospora* and *I. hieroglyphica* from Maine; *I. harveyi* from Maine and Massachusetts; *I. gravesii* from Connecticut, besides about as many more new varieties. *Athyrium* is given generic rank and separated from *Asplenium*, carrying with it the species *thelypteroides*, *filix-foemina* and *cyclosorum*. The synonymy is considerably fuller than in Professor Underwood's book, and the ranges are often modified and extended. We note still the omission of Unalaska as one of the stations for *Adiantum capillus-veneris*, although specimens are in herbaria which were collected on that island many years ago. The ranges of *Lycopodium*

clavatum and *L. complanatum* should be so extended as to include Iowa, as shown by Professor Shimek's recent list of Iowa Pteridophyta.

CHARLES E. BESSEY.
THE UNIVERSITY OF NEBRASKA.

MUSEUM NOTES.

PUBLICATIONS OF THE CARNEGIE MUSEUM.

WITH the issue of No. 1 of the *Annals of the Carnegie Museum*, this rapidly growing institution enters upon its career as a museum of publication; the publications are to appear as *Annals* and *Memoirs*, the first in octavo form, the second in quarto, and they are to be published from time to time as material is provided. In the 'Museum Notes,' with which this number of the *Annals* begins, it is stated that the Museum is to re-open the quarry at Como, Wyoming, where Professor Marsh obtained a number of his best specimens, including a number of skulls of Dinosaurs. The first systematic paper is by E. B. Williamson, on 'The Crayfish of Allegheny County, Pa.,' and describes six species. John A. Shafer gives a 'Preliminary List of the Vascular Flora of Allegheny County, Pennsylvania,' stating that it is issued largely as an incentive to others to participate in the preparation of a fuller, more complete catalogue. While the order of arrangement is that of Gray's Manual, the author states that this is selected merely as a matter of convenience and that he is fully in accord with the nomenclature of the most recent authors. The data on which the species are admitted to the list are indicated by means of signs. J. B. Hatcher notes 'Some New and little known Fossil Vertebrates,' showing that *Platacodon nanus* is unmistakably a fish and describing the character of the dermal covering of *Claosaurus*. Of special interest is a description of the principal characters of a primitive rhinoceros, *Trigonias osborni*, of which Mr. Hatcher was so fortunate as to secure an almost complete example, the species having been founded on the anterior part of the upper jaw and a ramus of the lower jaw. The dentition was noted as of a primitive type since three incisors and a canine were present on either side of the upper jaw. The rest of the skeleton agrees with this, the superior molars being simple in their structure, while there are four digits in the forefoot. D. A. Atkinson gives a list of 'The Reptiles of Allegheny County, Pennsylvania,' prefacing the paper with the remark that civilization means the destruction of a certain portion of the natural fauna of a region and that many species now rare in Allegheny County must have formerly been abundant, while two species have been exterminated within the last forty years, these being the prairie and the mountain rattlesnakes. In all, thirty-four species of reptiles are recorded. The concluding paper of the part is by R. W. Shufeldt on the 'Osteology of the Herodiones,' and contains a detailed description of the native genera of the group and with some foreign forms.

THE FIELD COLUMBIAN MUSEUM.

THE *Annual Report of the Director* of the Field Columbian Museum for 1899 1900 shows a marked increase of the collections in the line of anthropology, mainly in the way of material collected from the Hopi Indians and from the western States, through expeditions sent out. In botany is noted the accession of the Patterson herbarium of 30,000 North American plants, and a series of a thousand specimens from California and Colorado. A special form of herbarium case is described and figured which is said to combine freedom of access with security from insects and the exclusion of dust. Good progress has been made in cataloguing and labeling and a large number of books and pamphlets have been added to the library, making the present total somewhat over 24,000 titles. Two courses of eight lectures each were given during the year. The total number of visitors is not stated, but we are told that there was an increase of 42,595 over the previous year. The frontispiece of the report is an excellent portrait of the late George M. Pullman, and there are a number of full-page plates showing some of the ethnological and anthropological exhibits, among them two of Mr. Akeley's fine groups of African antelopes.

THE SOUTH AFRICAN MUSEUM.

PARTS IV. and V. of the *Annals of the South African Museum* are to hand, the former con-

taining a detailed description of 'The Anatomy of *Opisthopatus cinctipes* Purc., with notes on other, principally South African, Onychophora,' by W. F. Purcell, including the color variations, number of legs and distribution of the species. Part V. contains a 'Description of New Species of South African Pselaphidæ,' by Achille Roffray; 'Description of Seven New Species of the Family Mutillidæ,' by L. Péringuez, and 'Description of a New Species of the Genus *Japyx*,' by the same author.

F. A. L.

AQUATIC RESOURCES OF THE HAWAIIAN ISLANDS.

IN compliance with a resolution of Congress, Hon. George M. Bowers, United States Commissioner of Fish and Fisheries, is arranging to send an expedition to the Hawaiian Islands to make a comprehensive study of the fishes and other aquatic resources of those islands. The investigations will be under the immediate direction of Dr. David Starr Jordan, President of Stanford University, and Dr. Barton W. Evermann, the ichthyologist of the Commission, who will have the assistance of a number of experts.

It is the intention to make the investigations sufficiently comprehensive to enable the Commission to publish a very exhaustive report on the subject. The investigations during the present summer will be by shore parties and will pertain chiefly to the following lines:

1. A thorough qualitative and quantitative study of the commercial and shore fishes, mollusks, crustaceans and other aquatic animals and plants. Attention will be given to the actual and relative food values and commercial importance of the different species, their migrations, spawning time and place, food, feeding habits, enemies, maximum and average size, and other important facts in their life-histories.

2. The methods, extent and history of the fisheries, the kinds of apparatus used, the manner of using each and the species taken in each; the manner of caring for, and disposing of, the catch; the statistics of the fisheries, value of each kind of apparatus; number and nationality of people engaged in fishing; quantity an value of each species caught, and prices paid the fisherman, also the wholesale and retail prices; and changes in the methods of the fisheries since the coming of Americans, Europeans and Asiatics to the islands will be investigated.

3. The development of proper and just fishery laws will receive special consideration; the history of fishery legislation, including the system of tabu, and the present laws and methods with reference to each species covered by any law, special or general, and the possibility of trade in fishery products with the United States, improvement in the methods of the fisheries, and the methods of handling and marketing the fish will receive careful consideration. Attention will also be given to the possibility of fish-cultural operations with reference to such species as may be in danger of extinction or serious diminution.

Drs. Jordan and Evermann will sail for Honolulu May 30th and remain until September, when they will return to America and submit a preliminary report to Commissioner Bowers. Subsequently, they will return to Honolulu with the *Albatross* and make a study of the deep-water fauna of the islands.

The other members of the present expedition will be Dr. O. P. Jenkins, of Stanford University, Messrs. E. L. Goldsborough and John N. Cobb, of the United States Fish Commission, and Messrs. A. H. Baldwin and C. B. Hudson, who will paint in life colors the more important food-fishes of the islands. Messrs. Hudson and Baldwin are the artists who made the very accurate and beautiful colored drawings reproduced in Dr. Evermann's recent book on the Fishes and Fisheries of Porto Rico, of which Congress ordered the printing of an extra edition of 7,500 copies. It is expected that the Hawaiian report will be even more handsomely illustrated than is the report on Porto Rican fishes.

4. Mr. William H. Ashmead, Assistant Curator, Division of Insects, U. S. National Museum, will also accompany the expedition, and will make special efforts toward increasing our knowledge of the insect fauna of the archipelago.

THE BRITISH ANTARCTIC EXPEDITION.

DR. J. W. GREGORY, who was appointed scientific leader of the British Antarctic Expedition and as such recently contributed to *Nature* a plan of the scientific work, has now stated that he cannot accept service under the regulations laid down. This resignation, for so it has been regarded by the committee, is a very severe blow to the prospects of the expedition, or at least to the scientific results that might have been expected. Some, perhaps, prophesied failure when they saw the attempt that was made from the first to place the expedition under admiralty control and naval discipline. Friction and consequent heat became inevitable when the committee proceeded to appoint two leaders—a naval and a scientific—without defining their powers from the outset. It is well known that the meetings of this committee have been a series of fights between the geographers and naval men as opposed to the purely scientific men; and Dr. Gregory has over and over again been on the point of resigning. We understand that the ultimate dispute was over the question of landing, which Dr. Gregory wished to have fixed as a main object of the expedition, and not left entirely to the discretion of an unscientific commander. But the actual cause of rupture is immaterial. The position, thanks to the naval manoeuvres, has always been an impossible one for the scientific men While Dr. Gregory's absence in Australia has placed him at a disadvantage. Sir Clements Markham may be congratulated; but the committee will have a difficulty in finding a head for the scientific staff with half the competence of Dr. Gregory. The only satisfactory feature of the affair is that there has been no unpleasantness between members of the scientific staff, though doubtless some of them would be glad to follow Dr. Gregory's example.

SCIENTIFIC NOTES AND NEWS.

DR. FREDERICK PETERSON, of Columbia University, has been appointed by Governor Odell the medical member of the State Lunacy Commission. Dr. Peterson's appointment at the present time is especially fortunate, owing to the complications in connection with the State Pathological Institute, which will doubtless be settled with regard to the best interests of science and the care of the insane in the State hospitals.

AT a meeting of convocation on April 20th, McGill University conferred on Dr. Robert Bell, of the Geological Survey of Canada, the degree of Doctor of Science.

DR. JACOB ERIKSSON, professor of plant physiology at the Agricultural Station, Stockholm, has been elected a member of the Stockholm Academy of Sciences.

DR. ERNST KOKEN, professor of mineralogy and geology in the University at Tübingen, has been elected a corresponding member of the Geological Society of London.

THE Geographical Society of Paris has awarded the Henri Duveyrier gold medal to Dr. Cureau and the Alexandre Boutroue silver medal to Dr. F. Weisgerber.

CAMBRIDGE UNIVERSITY has conferred the degree of D.Sc. upon Professor A. H. Church, F.R.S., in recognition of his contributions to chemical and mineralogical science.

A. S. HITCHCOCK, of the Kansas Agricultural Station, has been appointed assistant agrostologist in the United States Department of Agriculture.

DR. CLAYTON H. SHARP, instructor in physics at Cornell University, has resigned this position to become testing officer of the Lamp Testing Bureau. This bureau is a corporation organized under the laws of the State of New York, which has hitherto been engaged solely in testing incandescent lamps, but which is in the near future to establish a laboratory in New York City for testing and standardizing not only electric lamps, but also all kinds of electrical apparatus and instruments.

DR. WILLIAM H. SQUIRES, who has spent the past two years in study at the University of Munich, is expected to return in September to Hamilton College, where he has been appointed professor of psychology, logic and pedagogics.

AT the general meeting of the Royal Institution, London, on May 6th, the following vice-presidents were nominated for the ensuing season: Sir Frederick Bramwell, Sir James Stirling, Sir William Abney, Lord Kelvin, Mr. George Matthey and Mr. Frank McClean.

DR. ERNST GILG has been appointed curator of the Botanical Museum of the University of Berlin.

DR. L. O. HOWARD, chief of the Division of Entomology, U. S. Department of Agriculture, lectured at Orange, N. J., on May 16th, giving practical information in regard to the relations of mosquitoes to disease and directions for exterminating the insects.

MR. ELWOOD MEAD, expert in charge of irrigation experiments, U. S. Department of Agriculture, Washington, D. C., is in Cambridge for the month of May giving a course of lectures on irrigation to the engineering students of Lawrence Scientific School of Harvard University.

WE learn from the *British Medical Journal* that the Croonian Lectures before the Royal College of Physicians of London will be given by Professor W. D. Halliburton, F.R.S., on June 11th, 13th, 18th, and 20th. The subject of the course is 'The Chemical Side of Nervous Activity.' The Goulstonian Lectures, 'On Certain Mental States associated with Visceral Disease in the Sane,' postponed owing to the illness of Dr. Head, will be given on June 25th and 27th, and July 2d.

THE sum which is being raised for the purposes (*a*) of placing a bust, relief or portrait in the Bodleian Library, and (*b*) of forming a fund to be called the 'Max Müller Memorial Fund,' which may be held by Oxford University in trust for the promotion of learning and research in all matters relating to the history and archeology, the languages, literatures and religion of ancient India, now amounts, as we learn from the London *Times*, to about £1,750. The subscribers include the King, the German Emperor, the King of Sweden and Norway, Prince Christian, the Duchess of Albany, the Prime Minister, the Crown Prince of Siam, a number of Indian princes, and a great many well known people in Oxford and the country generally. It is hoped eventually to raise £2,500, so that at least £2,000 may be available for the 'Memorial Fund.' Professor A. A. Macdonell is honorary secretary to the movement, and Mr. C. Grant Robertson, All Souls College, Oxford, honorary treasurer.

PROFESSOR H. G. VAN DE SANDE BAKHUYZEN, the Secretary of the International Geodetic Association, has sent from London an announcement calling attention to the death of Dr. Adolphe Hirsch, director of the Observatory at Neuchâtel. Professor Hirsch was a member of the Association, since the first meeting in Berlin in 1866, and was the following year elected secretary. This office he held for thirty-five years, having resigned it at the meeting at Paris last year, owing to the condition of his health.

DR. CHARLES RICE, chairman of the revision committee of the United States Pharmacopoeia, died in New York City on May 15th. Dr. Rice was born in Munich in 1841. He received a very thorough education in Vienna, Munich and Passau, acquiring a mastery of several oriental languages, the classics and the modern tongues. He was an accomplished linguist and was recognized as an authority on questions of philology and etymology. Dr. Rice came to America in 1862 and, during the war, served in the navy as surgeon's steward. After his discharge from service he entered the Department of Public Charities and Corrections, of New York City, and has been the chemist of that department and superintendent of its drug department for many years. He has served as chairman of the revision committee of the United States Pharmacopoeia since 1880, and, in the language of Dr. Horatio C. Wood, President of the last Pharmacopoeial Convention in May, 1900, 'has made it in its scientific accuracy, in its general usefulness and in the efficiency and elegance of its resulting preparations, the peer of the best.'

DAVID SHEPARD HOLMAN, the inventor of accessories to the microscope and other devices, died on May 13th. He was for a long time actuary of the Franklin Institute, Philadelphia, for which he frequently lectured. Recently he has been an expert in the laboratory of the Atlantic Refining Company.

THERE will be a civil service examination on June 3d for the position of soil analyst in the Bureau of Soils, Department of Agriculture, at a salary of $750. The subjects of the examination are physical chemistry, soil analysis, soil physics and German.

THE Godard and Bertillon prizes of the Anthropological Society of Paris will be awarded during the present year. The Godard prize (500 fr.) will be given for the best memoir on an anthropological subject, and the Bertillon prize (500 fr.) for the best memoir on a subject concerned with demography. Manuscripts or publications in competition for the prizes should be in the hands of the secretary of the Anthropological Society (15 rue de l'Ecole de Médicine, Paris) not later than July 11, 1901.

THE Federation of the Agricultural Unions of Italy has decided to offer an international prize of the value of about $200 to be awarded to the person who discovers and makes public the best method for obtaining exact and constant results in the determination of the fineness of the flowers of sulphur and of mixtures of sulphur and copper sulphate. Competitors must send in their papers in a sealed envelope to the head office of the Federation (Ufficio direttivo della Federazione Italiana dei Consorzi agrari, Piacenza, Italy) before March 1, 1902. The papers will be examined by a special commission to be named by the Reale Accademia dei Lincei, Rome.

THE extensive herbarium of the late Dr. T. Bernard Brinton has been presented to the Botanical Garden of the University of Pennsylvania.

CABLEGRAMS to the daily papers report that the observations of the solar eclipse on the 17th instant were only partially successful, the sun being more or less obscured by clouds. The corona was of the expected minimum type, being more diffuse and less definite than in the case of the eclipse a year ago.

A TELEGRAM was received on May 16th, at the Harvard College Observatory, from Professor R. H. Tucker, Lick Observatory, stating that Comet Queenstown was observed by Dr. R. G. Aitken, May $15^d.6668$ Greenwich Mean Time in R. A. $5^h\ 38^m\ 25^s.8$ and Dec. $+\ 3°\ 52'\ 12''$.

NEW YORK UNIVERSITY'S Hall of Fame will be dedicated on May 30th with elaborate ceremonies. The different tablets will be unveiled and addresses will be made. Professor B. L. Robinson, of Harvard University, and Professor B. D. Halsted, of Rutgers College, will unveil the tablet to Asa Gray, and Professor R. H. Thurston the tablet to Eli Whitney. The tablet to S. F. B. Morse has been assigned to the American Institute of Electrical Engineers, to be represented by Carl Hering, president, who will associate with him the president-elect. The tablet to Robert Fulton will be unveiled by James R. Croes, president, and Charles Warren Hunt, secretary, of the American Society of Civil Engineers. It has not yet been announced who will unveil the tablet to the memory of Audubon.

ACCORDING to a preliminary program, issued by the American Society of Electrical Engineers, the summer meeting of the Institute will open on August 14th, when a formal reception will be held in New York City. It is planned to spend the two following days in visits to the electrical works in the neighborhood, and on Sunday to go to Albany, traveling in part by boat up the Hudson River. On August 19th, the works of the General Electrical Company at Schenectady will be visited, after which the party will proceed by special train to Buffalo. It is proposed to hold the general meeting at Buffalo on Tuesday morning and to visit the Exposition in the afternoon. On the three following days the morning sessions will be devoted to the reading and discussion of papers. August 22d will, if possible, be devoted to an excursion to Niagara Falls, where the electrical works will be visited. The various sub-stations at Buffalo will also be open to members. The closing meeting will probably be held on August 24th.

THE Royal Society of Canada held its spring meeting at Ottawa, beginning with the meeting of the council on May 26th. We hope to publish some account of the proceedings in a subsequent issue.

THE second meeting of the Russian Surgical Congress will be held at Moscow in January, 1902 (9th, 10th and 11th), under the presidency of Professor A. Bobroff.

THE Liverpool School of Tropical Medicine will send to West Africa, during the present month, an expedition against the *Anopheles* mosquito under Major Ronald Ross. A leading Glasgow citizen has placed at the disposal of the school and Major Ross a sum of money sufficient to defray the expenses of one year's trial in some malarious city. A staff of workers with all necessary appliances will therefore be maintained at a selected West African city, attacking mosquitoes in the city and environs.

A SMALL collection of pictures, illustrative of the people of the Senegal and French Soudan and their customs, painted by M. Joseph de la Nézière, is on exhibit at the rooms of the Royal Geographical Society, London.

A CORRESPONDENT to the London *Times* writes that the meeting of the Royal Society on May 9th was strictly private, the usual admission of a certain number of the general public being suspended. The Society was engaged in discussing the report of a committee appointed to consider some means of establishing a British academy of larger scope than the existing Royal Society, which should represent philosophico-historical branches of study, as well as the more exact sciences to which the Royal Society has in the main, if not altogether, confined itself. The idea sprang out of the fact that the Royal Society has taken an active part in the formation of an international association of the principal scientific and literary academies of the world. This association is divided into two sections—scientific and literary. While the Royal Society can represent Great Britain in the scientific section, it seems that it has no organization eligible to represent Great Britain in the other section, which includes history, antiquities, philosophy, economics and so forth—subjects which may be studied in a scientific spirit, but do not lend themselves to experiment and exact verification. The discussion, like the report upon which it was based, was inconclusive. The Royal Society shrinks from taking an active part in the formation of another academy dealing with the subjects in question, which might in various ways, and especially in its demands upon the public purse, become a serious rival to the Royal Society itself. The only alternative is that the Royal Society should enlarge itself in one way or another so as to include the studies classed on the Continent as literary. But, though more than one way of doing this has been suggested, the difficulties in every case are obvious and great. So far as can be gathered, the weight of opinion in the Royal Society is against any attempt to meet what, after all, is a rather visionary demand. If the disadvantages flowing from the want of an academy are as serious as they are represented, it is obviously the students of the subjects in question who ought to supply the need they feel. The Royal Society has a vast field for its energies in connection with its own proper work.

UNIVERSITY AND EDUCATIONAL NEWS.

PRESIDENT J. H. BARROWS has announced that of the \$300,000 necessary to secure the conditional gift of \$200,000, offered by Mr. John D. Rockefeller to Oberlin College, the sum of \$150,000 has already been promised.

A GIFT of \$25,000 to the Yale Bicentennial Fund has been made by William C. Whitney, of New York City.

MRS. S. H. CAMP, of Hartford, Conn., has given \$10,000 to the Philosophical Department of Yale University for a departmental library.

IN 1897 Governor Roswell P. Flower presented to Cornell University \$5,000 to found a library for the use of the New York State Veterinary College; and Mrs. Flower has now given \$10,000 to endow this library. With the books and periodicals obtained with the original gift, and those which can be obtained from year to year by the income of the endowment fund, it is believed that the Flower Library will become one of the best equipped libraries of comparative medicine in the world, and be

of great service to the live stock interests, and therefore an important factor in the prospeiity of the State.

Mr. William Johnson, a Liverpool ship-owner, has established two fellowships in physiology and pathology, in University College, Liverpool, one open to members of British colonial universities and medical colleges; the other to foreign students and intended especially for students in the United States. The provisional regulation governing the latter fellowship are as follows:

1. This fellowship has been founded to commemorate the late John W. Garrett, of Baltimore, United States, and shall be called 'The John W. Garrett International Fellowship in Pathology and Physiology.' The value of the fellowship shall be £100 a year.

2. The fellowship shall be open to members of universities and medical schools in the United States, without, however, absolutely precluding members of other foreign schools.

3. The fellow shall be elected by the faculty, on the nomination of the professors of pathology and physiology.

4. The fellow shall be elected for one year and shall be eligible for re-election.

5. The fellow shall devote himself to research in physiology or pathology and bacteriology under the direction of the professors of physiology and pathology. He shall undertake no work which shall in any way interfere with these duties.

6. The work shall be done in the Thompson-Yates laboratories of University College, Liverpool, but, by special permission from the faculty, the fellow may be allowed to follow his investigations elsewhere.

7. The expenses of the research shall be met out of the funds of the laboratory under the direction of the professors of physiology and pathology.

The committee of the National Educational Association on a National University met at Columbia University May 23rd. It was expected that the committee would then adopt its final report. This will doubtless be on the lines of the preliminary report that we published some time ago. A national university will not be approved, but plans for utilizing the scientific opportunities at Washington will doubtless be proposed.

Dr. John E. Clark, James E. English professor of mathematics at Yale University, has retired on account of ill health. He has been made professor emeritus, and Dr. Percy F. Smith, associate professor of mathematics, has been appointed as his successor. In the Sheffield Scientific School of the same university, Dr. Earle Raymond Hendrick, of Ann Arbor, has been appointed instructor in mathematics, and Mr. Edwin Hoyt Lockwood has been promoted to an assistant professorship of mechanical engineering.

Dr. Truman H. Safford, professor of astronomy at Williams College, has retired from the active duties of his professorship.

At Harvard University Dr. Jay Backus Woodworth has been promoted to an assistant professorship of geology, and James K. Whittemore has been made instructor in mathematics.

Dr. Joshua W. Beede, B. S. (Washburn College) and Ph.D. (Kansas) has been elected instructor in geology in Indiana University.

The following fellowships in the sciences have been awarded at Cornell University: The McGraw fellowship, Augustus Valentine Saph, B.S., M.S. (California), in civil engineering; the Schuyler fellowship, Kūchi Miyake, Imperial University of Tokyo, in botany; the Goldwin Smith fellowship, Lee Barker Walton, Ph.B. (Cornell), A.M. (Brown), in entomology; the President White fellowship, Floyd Roe Watson, B.S. (California), in physics; the Erastus Brooks fellowship, John Wesley Young, Ph.B. (Ohio State University), in mathematics; Susan Linn Sage fellowships in philosophy and ethics, John Wallace Baird, A.B. (Toronto), Georgia Benedict, A.B. (Wells), and Henry Wilkes Wright, Ph.B. (Cornell).

Dr. J. N. Langley, reader in histology at Cambridge University, has been appointed, for a period of two years, as deputy for Sir Michael Foster, M.P.

Mr. W. E. Thrift, fellow of Trinity College, Dublin, has been elected Erasmus Smith professor of natural and experimental philosophy, in succession to the late Professor Fitzgerald.

Dr. B. Němec, docent in botany at the Bohemian University at Prague, has been appointed director of the Institute for Plant Physiology.